

Name :

Entry Number :

EEL851 : Selected Topics in Computers

Signals and Systems in Biology [Major, Genomics]

Time : 40 mins

Max Marks : 20

Describe 3 different ways of estimating randomness of a discrete sequence. What do you expect to see when these methods are applied to DNA sequences? [5 marks]

Hypothesis: The inter-nucleotide distance in a DNA sequence follows the exponential distribution.

Briefly describe an algorithm that you will use to test this hypothesis.

[5 marks]

Consider a sub-sequence from the DNA sequence of *E. Coli*:

[4 marks]

AGCTTTTCATTCTGACTGCAACGGGCAATATGTCTCTGTGTGGATTAAAAAAGAGTGTGTC

What is the entropy (base 2) of this sequence [Steps and Answer]? What does it imply?

An alien civilization has been discovered and it contains organisms from only 2 species: Hobbits and Elves. The survival fitness of Elves is known to be double that of Hobbits. Though Elves are immortal, they can mutate into Hobbits. Hobbits cannot mutate back into Elves but can die due to the natural process of ageing. Describe a model that can capture the population dynamics of this civilization. For what rates of mutation and/or death, can one or both of these 2 species go extinct?

[6 marks]